

# Chapter 11

## Non-Point Sources of Pollution

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### **Priority Problems**

The control of non-point source (NPS) pollution, from literally thousands of possible sources is one of the most difficult areas of environmental management. Sources of such runoff include residential properties, agricultural uses, roadways, municipal stormwater runoff and runoff from industrial and commercial properties which can introduce potentially harmful products into Galveston Bay. The intensity of land development and human induced subsidence, which has reduced wetlands, around Galveston Bay intensifies the problem by removing nature's ability to naturally cleanse this runoff as it proceeds to the bay.

It is estimated that over half of the sediment, phosphorous, fecal coliform bacteria, and oxygen demanding substances introduced into the bay system originate from non-point sources (GBNEP, 1994). Only fecal coliforms have been identified as posing an immediate threat to the open bay. There are, however, notable problems in the urbanized bayous and enclosed areas with poor circulation. Water and sediments in marinas are degraded from boat sewage and introduction of dockside wastes from non-point sources. This is exacerbated by poor circulation and has created localized water quality problems. Other specific problems include DO problems in the HSC, fecal coliform exceedences above contact recreation levels in Dickinson Bayou and Clear Creek, high nutrient concentrations and pollutants from local marinas. In general, non-point sources contribute high levels of fecal coliforms to the bay, causing about half of the bay to be closed to oyster harvesting, and polynuclear aromatic hydrocarbons, which accumulate in seafood.

### **Management Goals and Objectives**

The following were established as priority water non-point pollution management goals:

- To reduce urban NPS pollutant loads,

- To reduce industrial NPS pollutant goals,
- To reduce agricultural NPS pollutant loads, and
- To reduce construction NPS loads

To implement programs to reach these goals the following objectives and action plans were developed.

Objective 1:	Establish a regulatory framework for NPS control throughout the entire immediate Galveston Bay watershed within 5 years.
Action NPS-1	Implement stormwater programs for local municipalities.
Action NPS-2	Perform pilot programs to develop NPS best management practices.
Objective 2	Reduce NPS loads from existing development. In particular reduce PAH loadings from non-point combustion sources and to reduce bacterial loadings affecting oyster harvest areas.
Action NPS-3	Identify and correct priority watershed pollutant problems.
Action NPS-4	Establish residential load reduction programs.
Action NPS-5	Correct malfunctioning shoreline septic tanks.
Objective 3	Reduce urban NPS loading from new development Using technically based best management practices. Pollutants of particular interest for open bay waters are fecal coliform bacteria.
Action NPS-6	Implement NPS reduction Plan Program for New Development.
Action NPS-7	Establish Roadway Planning to minimize NPS effects.
Objective 4	Ensure implementation of industrial NPS programs within 5 years
Action NPS-8	Implement NPDES stormwater program for area industries.
Action NPS-9	Prevent degradation of bay waters by known industrial groundwater plumes.
Objective 5	Manage agricultural runoff to satisfy water quality standards within 5 years.
Action NPS-10	Develop inventory of agricultural non-point sources.
Action NPS-11	Coordinate and implement existing agricultural NPS control programs.
Objective 6	Reduce erosion from construction sites to the maximum extent practicable within 5 years.

Action NPS-12 Adopt regional construction standards for NPS reduction.

Objective 7 Limit migration of toxics and nutrients from construction sites within 10 years.

Action NPS-13 Implement toxics and nutrient control practices at construction sites.

Objective 8 Achieve zero discharge from marinas to surface water within 10 years.

Action NPS-14 Require sewage pump out, storage, and provisions for treatment.

Action NPS-15 Require use of marine sanitary chemicals that can be treated in POTWs.

Objective 9 Eliminate the release of harmful materials (paints, solvents, etc.) from marinas and docksides within 10 years.

Action NPS-16 Implement wash down controls and containment measures.

In general, the most effective and economical controls for NPS are land management techniques and conservation measures in rural zones and implementation of technology-based best management practices in urban zones. For this reason this plan seeks to implement best management practices through regulation and public education. It addresses the regulatory activities of local, state, and federal agencies; the need for public awareness campaigns; development of improved dockside and construction site procedures; management of agricultural run-off; and improvements to septic systems.

### **Data Information Needs**

NPS pollutants enter surface waters in a diffuse manner and are transported to the bay by the stream systems, storm drains, or overland flow draining geographic areas. Because of the diffuse and intermittent nature of NPS pollution it is generally not possible to monitor at their point of origin. NPS pollutants cannot easily be measured in terms of effluent limitations.

Environmental monitoring for NPS pollutants in the GBRMP will from necessity be very broad and non-specific in terms of spatial coverage. The tributary and stream monitoring efforts of the GBRMP will include measures of NPS pollutants of concern (TSS, BOD, nutrients). This monitoring effort will assess the combined load from all, point and non-point, sources upstream of the monitoring stations. The ability to measure the effectiveness of program actions through this monitoring effort will be difficult and elusive and can be used only in the broadest context.

An important future source of information concerning NPS pollutants will be the NPDES stormwater permit program. The Storm Water Management Joint Task Force, which includes Harris County, Harris County Flood Control District and the City of Houston, has submitted a Joint permit application to the EPA and is awaiting permit issuance. The Galveston Bay Program will work with permitted entities to gain access to data and information made available through this monitoring program.

Many of the elements of NPS monitoring are common to all of the individual objectives stated for NPS controls. For this reason each objective will not have a separate monitoring discussion. Discussion of the monitoring for non-point sources is summarized below in a generalized, overview format. Much of the monitoring for this element will be programmatic in nature, directed toward implementation of Best Management Practices (BMPs) and other specific management actions.

### **Programmatic Monitoring**

*The Plan* highlights the specific activities to be carried out in achieving plan actions. The monitoring plan will not attempt to reiterate all of these tracking and participatory obligations to The Program. The specific actions to be taken to measure success of the actions will however be discussed.

Each of the objectives 1, 3, 6, and 7, will require adoption of ordinances, drainage regulations, codes or zoning plans by local municipalities. Intermediate success of these action plans will be measured in terms of adoption of such NPS management plans and the appropriate legal authority. This can be measured through surveys of all local municipalities. Types of information to be obtained in these surveys would include implementation of, regulatory authority for, and enforcement mechanisms for:

- NPS BMP guidance,
- Stormwater management plans,
- Residential load reduction programs,
- Regulations on shoreline septic tanks,
- Reduction plans for new development,
- Policy of incorporating NPS control and prevention measures into roadway planning, construction, maintenance and design,
- Construction standards for NPS reductions,
- Measures to control toxic and nutrient control practices at construction sites, and
- Marina sewage and wash down control and containment measures.

In addressing agricultural NPS loadings the plan also calls for the development of better estimates of agricultural NPS contributions to Galveston Bay and guidance documents for NPS controls. The Program will coordinate with the Texas Soil & Water Conservation Board (SWCB) in an interagency effort to better characterize agricultural NPS pollution. BMPs developed as a result of this effort will be incorporated into the Galveston Bay BMP Performance Document. The Program will work with the SWCB to evaluate the implementation of agricultural BMPs.



Industries will be monitored for their efforts to meet the requirements of the federal storm water permit program and implementation of pollution prevention plans. This information may also be obtained through surveys or may be available through local industrial associations. Actual stormwater discharge contaminant data will be reported through the NPDES permit process and will be available for review and evaluation.

*Action NPS-1* calls for the development of stormwater management plans for the watershed area. Current action is primarily directed at the efforts of the Joint Storm Water Task Force (Houston, Harris County, Harris County Flood Control District and Pasadena). This group is charged with meeting the requirements of the federal stormwater permitting program. Future actions will be to monitor any new requirements for smaller municipalities and to track their implementation.

Included in this monitoring effort will be an inventory of all local cities and the status of their stormwater management plans. Cities without plans will be encouraged to develop them. Information on local effectiveness of BMPs and other management plans will be collected by a Technical Assistance Group.

*Action NPS-2* will require the monitoring of pilot programs to determine best management practices for new development. Onsite monitoring will be conducted to quantify the effectiveness of implemented practices and to develop a bay-wide BMP performance document. Monitoring will be conducted by Harris County or TNRCC.

In response to Actions NPS-3 & 4, The Program will monitor local agencies for participation in pilot projects and use this information to compile the *Galveston Bay BMP Performance Document*. In addition the Program will maintain and publish its own inventory of NPS concerns in the bay watershed. Sources of information will include the Texas Clean Rivers biennial basin assessment reports, GBNEP NPS loading maps, state 305b reports.

The Galveston Bay Program Office will implement a NPS education program (NPS-4) directed at reducing NPS loadings from residential activities, including lawn and garden activities, household hazardous wastes, automotive fluids and storm sewer dumping. The Program will coordinate with local governments and organizations to inventory activities in this area. Beginning in 1999 the Galveston Bay Program will participate in evaluating the effectiveness of this program through household surveys aimed at measuring changes in household activities as a result of education efforts.

*Action NPS-5* will conduct surveys to evaluate the implementation of local ordinances directed at reducing fecal coliform pollution from septic tanks.

*Action NPS-6* This program is designed to bring together the current patchwork of regulatory agencies to jointly address the problem of coastal NPS pollution. The lead agency for this action is the GLO. The Program has tracking responsibilities for this action.

*Action NPS-7* The Program will work with the Texas Department of Transportation (TXDOT) to organize educational workshops for county highway agencies, municipal public works programs and others regarding NPS control and prevention in roadway planning, design, construction, operation and maintenance. A major emphasis of this action is reduction of TSS loadings. Records of training programs will be maintained by The Program to document this action. The Program will promote demonstration projects and will document through case studies successful implementation of NPS control and prevention measures. Local agencies will be surveyed for adoption and implementation of proven technology.

*Action NPS- 8* The Galveston Bay Program will track industry activities in the bay for implementation of stormwater management and pollution prevention plans. The Program will also collect NPS monitoring data from numerous sources to develop NPS loading estimates and estimates of industrial contributions.

*Action NPS-9* Potential ground water impacts to the bay will be inventoried. GIS data maps will be created to indicate known sources of groundwater plumes. This information will come from sources such as CERCLA, RCRA, the Leaking Petroleum Storage Tank Program, the Oil Pollution Act and the Clean Water Act.

Activities, including on-site monitoring, to assess BMP effectiveness will be coordinated by the Texas State Soil & Water Conservation Board. Specific activities are outlined in detail in *The Plan*. The Galveston Bay Program will monitor the development of agricultural BMPs for their inclusion into the Galveston Bay BMP Performance Document. The success of this element will be monitored through documentation of agricultural NPS BMP implementation within the watershed. This objective will include development of educational programs.

*NPS-14 and 15* Marinas providing moorage to 10 or more vessels will be required, by state regulation; to provide pump-out facilities for marine toilets and pollution prevention plans addressing wash down controls and containment measures. Activities for this action plan are not scheduled until 1999. Mechanisms for measuring compliance with this action have not been established but compliance will be monitored to assess action effectiveness. Programmatic monitoring for this action will include monitoring local municipalities for adoption of NPS ordinances or changes in local drainage regulations, codes and zoning plans. Again, implementation will be judged largely on the level of implementation of BMPs directed at NPS reduction. Monitoring for this element may include examinations of marina facilities for compliance with local or state regulations. Self reporting through surveys sent out to marina owners is another option. Specific details for measuring compliance with this action have not been determined. When local ordinances are implemented a means of monitoring for compliance will be developed.

## **Environmental Monitoring**

Because of the diffuse and pervasive character of NPS pollution, it's intermittent nature and the high levels of variability it exhibits, it would require a tremendous commitment of monitoring resources. The ability of the GBRMP to assess site

specific NPS control effects will be limited due to its broad scope. The GBRMP will work closely with the Houston-Galveston Area Council (H-GAC) to coordinate assessment work under the Clean Rivers Program to address nonpoint source pollution from upstream areas within the Galveston Bay watershed. GBRMP stations located at USGS gauging stations will provide some information on loadings to the system. Information of this type will not assess individual activities but will integrate the effects of all activities within a watershed.

Stream monitoring under the GBRMP will monitor for long term trends in nutrients, fecal coliform, DO and TSS and related parameters in the ambient water column. Through cooperation with all monitoring entities, regional monitoring protocols for sampling and analytical methods have been developed. Through use of these protocols all monitoring information collected within the watershed will be comparable and will be submitted to one central database. Current agency monitoring sites for stream monitoring will be maintained with future evaluations allowing relocation of resources or addition of new sites.

As previously stated, elements of the GBRMP will not attempt to address localized effects of NPS control measures. Information on effects of site specific activities will be available through NPS pilot projects to be conducted within the Galveston Bay watershed. The TNRCC will establish Galveston Bay as a demonstration area for coastal urban NPS pollution abatement. This will make potential sponsors of NPS pilot projects eligible for State funding as demonstration projects. These demonstration projects will include monitoring to establish BMP effectiveness. This monitoring information will be obtained and evaluated by Galveston Bay Program staff.

In cooperation with the H-GAC, the TNRCC has selected the Dickinson Bayou watershed as a pilot study area to assess the impacts of nutrient loadings from storm water runoff to the Dickinson Bayou watershed. Water quality concerns previously identified in the study area include: 1) nutrient enrichment, 2) critically low dissolved oxygen levels, leading to periodic fish kills, and 3) elevated fecal coliform concentrations. The primary objective of the proposed study is to define nutrient loadings to Dickinson Bayou and secondarily, to define sources of nutrients and their effects on the Bayou. Water samples will be collected monthly and during storm events, and analyzed for a variety of nutrients. First year analyses will include temperature, specific conductance, pH, total alkalinity dissolved oxygen, suspended sediment, chlorophyll-a, chlorophyll-b, phytoplankton biomass, and total and dissolved forms of nitrite, nitrate-plus-nitrite, ammonia, ammonia-plus-organic nitrogen, phosphorous, and ortho-phosphorous. These data will be used to quantify nutrient loads and also will be used to relate nutrient loads to selected land uses in the water shed. Nutrient loadings and yields will be available for instantaneous, storm event, seasonal and annualized time frames.

Stormwater sampling, to be conducted under the soon to be issued NPDES stormwater permits, will be an additional source of information for this action plan. Monitoring information anticipated to be available under this program includes: data collected as part of a dry weather screening program, wet weather screening, representative monitoring from storm event discharges, and monitoring for

floatables. The dry weather program will be an ongoing effort to detect and identify illicit connections and improper discharges to the Municipal Separate Storm Sewer System (MS4). (See also Chapter 11.0- Point Sources of Pollution) Wet weather screening will be used to identify areas of excessive pollutant discharges. Floatables monitoring will consist of reports of volumes of debris removed from structures designed for removal of floatable materials. Representative monitoring from storm events will be conducted to characterize the quality of storm water discharges from the MS4. Monitoring at these stations will be conducted to characterize the quality of storm water discharges from the MS4. The Joint Task Force has identified 5 sites for representative monitoring. These sites were selected to be representative of specific land use patterns. Quantitative data collected under this program will be used to estimate pollutant loadings and event mean concentrations (EMC) for each parameter sampled. An EMC is the flow weighted average concentration of a water quality constituent over the course of an entire storm event (Newell, 1992).

Because of their limited circulation, intensity of use, and the potential for pollution from boat maintenance activities, marinas will be designated as special monitoring areas. Recent studies have indicated that the non-point water quality impact to marinas is localized within the immediate vicinity of the marina. Because of these circumstances it may be possible to directly measure NPS improvements through site-specific monitoring. Low dissolved oxygen values and elevated concentrations of copper, lead, and arsenic have been associated with marina sites. The Galveston Bay Program will work with citizens monitoring groups to establish sampling sites to monitor DO in marinas as part of this monitoring element.

Non-point sources contribute greatly to suspended solids loads to the bay. The ultimate repository for these suspended solids is bay-area sediments. The sediment quality monitoring element of the GBRMP can therefore serve as an indicator of NPS effects on the bay. NPS are important contributors of several priority pollutants such as PAHs and heavy metals. Sediment quality studies performed by GBNEP found the most significant effects in small enclosed bays near highly urbanized areas. Preliminary data from the EPA, 1993 R-EMAP study which included sediment stations near selected marinas, found elevated levels of tri-butyl tin associated with the marina stations (E. Hornig, U.S. EPA-Region 6, personal communication). Sediment monitoring of these small embayments will continue as a special element within the GBRMP.

Loading estimates indicate that non-point source runoff is probably the largest contributor of fecal coliform to Galveston Bay (GBNEP, 1994). The National Urban Stormwater Runoff Program identified coliform bacteria as the primary indicator of adverse effects of urban runoff to marine waters (USEPA, 1983c). In the Galveston Bay system several streams appear, at times, to exceed the state water quality criteria for fecal coliform bacteria and it is believed that non-point sources of fecal coliforms are significant contributors of coliform bacteria which are responsible for preventing oyster harvesting in some parts of the open bay. As a matter of fact, in several oyster harvest areas, this relationship is so well documented that oyster harvesting is conditionally approved based on meteorological conditions. For example, in conditionally approved area 1, when a 7-day rainfall at San Leon or the closest available National Weather Service rain gauge exceeds 2 inches, this area is



closed for harvesting. Historical information shows that coliform counts in these areas increase according to the flows received from nearby streams. Much of this increase is attributed to NPS contributions. GBRMP fecal coliform data may be useful as an indicator of the effectiveness of NPS actions in some areas.

An important component in development of NPS loading estimates is land cover information. An additional monitoring element which will provide valuable information will be the land-use monitoring element of the habitat quality monitoring program. Obtained from the land use classification data available from the TPWD Coastal Habitat Monitoring effort this information will allow updates of land-use information on a two-year cycle. Land-use has been closely linked to NPS pollution loads. Using updated land-use information, estimates of urban NPS loading can be revised.

